FAA AVIATION NEWS

JULY 1969

COVER

Summer is the season
of sudden storms.
For help on how to steer
clear of troubled air,
see "Stormy Weather," page 10

FAA AVIATION NEWS

DEPARTMENT OF TRANSPORTATION / **FEDERAL AVIATION ADMINISTRATION** VOL. 8 NO. 3

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FAA AVIATION NEWS is published by the Office of Information Services, Federal Aviation Administration, Washington, D. C. 20590, in the interest of aviation safety and to acquaint readers with the policies and programs of the agency. The use of funds for printing FAA AVIATION NEWS was approved by the Director of the Bureau of the Budget, July 14, 1967. Send change of address to the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402, with a mailing label from any recent issue. Single copies of FAA AVIATION NEWS may be purchased from the Superintendent of Documents for 20 cents each.

"... No one wants traffic demand restricted. Therefore, we must accommodate current and expected growth in aircraft operations with appropriate improvements to the system."

John H. Shaffer, FAA Administrator.

PAY A$ WE GROW

A ten year Federal commitment to provide an average of $250 million a year for airport construction and planning, and a like amount for improving and expanding air navigation facilities has been recommended to Congress by President Nixon.

Under the "Aviation Facilities Expansion Act of 1969," proposed by the Department of Transportation's Federal Aviation Administration, two-thirds of the $14.5 billion needed for a ten-year expansion program would be raised by new taxes on air carrier transportation and on general aviation, with the remaining third drawn from general tax sources. The general aviation share would consist of a flat nine cents per gallon tax on all aviation fuels.

The new airport program is based on an indicated need for 900 new public airports and the improvement of 2,750 others by 1980. A special allocation of $10 million annually in matching grants would be available to area planning agencies, and up to $5 million annually could be provided to state aviation agencies for airport planning and development.

Air navigation facilities would be expanded, with the construction of additional airport control towers, radar installations, instrument landing systems and communication networks. The present air traffic control system would be modernized and automated as fully as possible, while at the same time research and development was undertaken to prepare for more advanced systems of the future.

The "pay-as-we-grow" plan is considered the only practical alternative to further restrictions upon private and commerical flying.

In September of 1966, for the first time in the history of American aviation, a limit was placed on the number of commercial aircraft that could use an airport. Delays and congestion at Washington National Airport were threatening to interfere with the processes of government, as well as the functions of business and the interests of private individuals.

On June 1, 1969, less than three years later, all aircraft operations were limited at five of our busiest airports—O'Hare in Chicago, JFK, Laguardia, and Newark, in the New York metropolitan area, and Washington National.

These restrictions, devised with the utmost of reluctance by the Federal Aviation Administration, are sure indications that the national airspace system has not been able to keep pace with the growth of aviation.

Highlights of 1969 AVIATION FACILITIES EXPANSION ACT

TAX SOURCE	OLD TAX	NEW RATE
Passenger fares • domestic	5 percent	8 percent
• international & overwater	none	$3 per person
Air freight waybills	none	5 percent
Non-commercial * aircraft fuel		
• gasoline	2 cents/gal	9 cents/gal
• jet fuel	none	9 cents/gal

* Excludes aircraft carrying passengers or property for hire, or used in agriculture.

In recent years, FAA has been obliged to enact an increasing number of rules governing air traffic procedures and flight equipment in order to maintain safety standards under conditions of rapidly increasing use of the airways and airports.

In his message to Congress on the future of air transportation, President Nixon said that "the challenge confronting us is not one of quality, or even of technology. Our air traffic control system is the best in the world; our airports among the finest anywhere. But we simply do not have the capacity in our airways and airports ample to our present needs or reflective of the future."

Increasing this capacity will involve expenditures that cannot be met by general taxation or current revenues alone. Aviation is growing at such a fantastic rate that a minimum of $5 billion is needed over the next decade in order to merely keep up with the demands for service and facilities.

In air traffic control, for example, FAA has some nearly 24,000 specialists in over 700 flight service stations, towers and centers. To maintain the same service provided currently, this number would have to grow to 43,000 by 1980. Today some 6,500 technicians maintain FAA's communications network; over the next ten years this number would have to grow to 3,700 to match the predicted growth of the industry.

Throughout the country there is a need for more and better airports, for longer runways, for better lighting and NAVAIDS. The widespread use of jets, turboprops and other high performance aircraft, in general aviation as well as in air carrier service, has far outstripped the ability of local governments to build and improve airports.

To avoid congestion in the air and to provide space for continued growth of the civil air fleet, the nation will require intense research and development, as well as costly acquisition of new hardware. To postpone the day of reckoning would only lead to increased restrictions.

Fortunately for the aviation community, Presidential recognition has now been given to the importance of all phases of aviation, and to the necessity for legislation that will make a major expansion of both airways and airports possible. The Aviation Facilities Expansion Act of 1969, which will distribute the tax burden in accordance with the benefits derived from the system, will insure the future of aviation in this country. ■

FROM CHECKPOINTS TO WAY POINTS

How Area Navigation Will Change the Traffic Picture

The most promising solution to overcrowded airways appears to be some form of area navigation that will allow use of off-airway airspace without requiring additional ground facilities (FAA AVIATION NEWS, Dec. 1968) FAA has been evaluating commercially developed area navigation systems over the past year, and has laid down specific guidelines for the certification and use of these systems.

The need for obtaining greater utilization of the basic VORTAC system has been apparent for some time. There are 885 VORTACs in the United States, usually located near or on airports, but there are over 10,000 airports. It is patently impossible to "fly the OMNIs" without flying a zigzag course. In a transcontinental flight a pilot may add a hundred miles to the tapeline distance between two cities.

Also, the pilot who is flying from VOR to VOR may sometimes find it necessary to detour around storm centers. Unless he is assisted by radar vectors, he is likely to have difficulty plotting a course which does not take him many unnecessary miles away from his intended flight path, unless he is able to use some form of area navigation.

Furthermore, air traffic delays tend to build up around busy airports as the airways funnel traffic into a confined area. In IFR weather, the acceptance rate of the airport is limited, in part, by both the need for aircraft to report over ground facilities while making an approach, and the need to protect the airspace around those facilities.

Area navigation is by no means a new concept. It has been practiced for years by pilots who use VOR-DME to establish a number of checkpoints along a course line plotted directly from their departure point to their destination. What is new about the area navigation system is that it adds to the VOR-DME instrumentation an airborne course line computer that is capable of guiding the pilot to his checkpoints, referred to as "way points" in the system, just as the OMNI needle guides him to the VOR stations.

Way Points Limitless

The way point is defined by FAA as a geographical point determined by airborne and ground-based aids or by a self-contained airborne navigational system (such as an inertial platform system which reads out latitude and longitude coordinates).

Way points are identified by geographical name, bearing and distance from the reference facility (usually a VORTAC), and latitude and longitude. The number of possible way points is infinite, although only those identified on proposed FAA IFR charts may be used on IFR flight plans.

A succession of way points make up an area navigation course, which can be programmed into the computer component by the pilot in advance and changed en route in order to fly around weather cells. Or, instead of being vectored around a storm by radar controllers, the pilot may be given a detour course in terms of a number of way points which he can dial into his system.

The VFR pilot already has available VFR planning charts specially designed for area navigation, such as the "Jepco Avigation" charts. These charts locate all VORs and all VORTAC's and give their radio frequencies as well as mileage indications along their four primary radials. Latitude and longitude coordinates further assist the pilot in plotting his course, and obstruction or terrain clearance altitudes are provided.

Pilots using such a chart may simply draw a straight line from airport of departure to their destination and establish a number of way points along the line with reference to appropriate VORTAC's. If the airports he is using do not have VORTACs, he can nevertheless establish way points directly over the runways.

A pilot flying VFR from Columbus, Ohio, to Gary, Ind., for example, could establish a starting way point at the Columbus Airport from the Appleton VORTAC. His first en route way point could be set up neary Marysville from the Rosewood VORTAC, and his second near Knoxville, also from the Rosewood VORTAC, etc. His final way point at Gary would be established from the Chicago Heights VORTAC.

Once his course was plotted, the pilot would have to check his sectional charts to determine where his intended flight path would encounter prohibited areas and controlled airspace.

Then he would be able to program his way points into his area navigation computer, giving radio frequencies, radials and distance, and be given course guidance on his instrument panel.

Some of the area navigation systems on the market use a needle display simialr to the OMNI needle, except that mileage information is displayed as well as directional indications. Others use some form of pictorial display that enables the pilot to follow

Pilot uses airborne computer to dial selected way point as he would set OMNI heading to VOR checkpoint on airway. Arrow indicates track and distance display.

his course with reference to a chart. Inertial platform systems usually present a tabular readout of latitude and longitude, as well as distance and bearing.

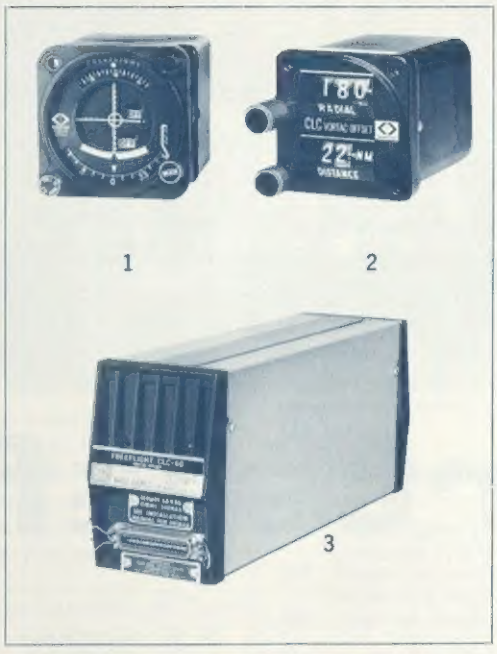
FAA has evaluated a half dozen area navigation systems, ranging in price from $5,000 to $90,000: Butler VAC, NARCO, Hughes, Decca Omnitrac, Litton and AC Electronics (the latter two are inertial systems and have the highest price tags; they are designed primarily for long distance and over water flights).

For instrument flight, FAA is preparing an IFR area navigation chart which will establish a number of specific way points to be used in controlling IFR traffic, and for approaches. By increasing the number of reporting points, and by not being limited to ground-based facilities for location of the points, the air traffic system will greatly improve its capacity to handle instrument traffic.

System Standards

To meet FAA standards, the area navigation systems will have to provide course guidance accuracy equivalent to that provided by VOR airways. Maximum error tolerance for both equipment and piloting error:

- En route . . . plus or minus 4.0 nautical miles.
- Terminal areas, within 25 miles of a VOR . . . plus or minus 2.0 nautical miles.



One simple area navigation system uses (1) course indicator, (2) VORTAC offset controller, and (3) a computer.

- Final approach, within 10 miles of a VOR . . . plus or minus 1.0 nautical miles.

System safeguards will include a system failure warning display and a means of checking the accuracy of the system in flight. The system should operate at least 750 hours without breakdown.

At airports, without instrument landing systems, a way point will be located by FAA on the runway centerline extended. The bearing and distance to the reference facility will be given to the nearest tenth, i.e., 337.2°, 14.3nm. Turn-on way points will be established where needed. Step down fixes on the final approach course will be shown as the distance from the way point.

To use area navigation in the IFR environment, pilots must comply with all FAA established area navigation routes in the airspace through which their flight plan will take them. A box on their flight plan will indicate this capability.

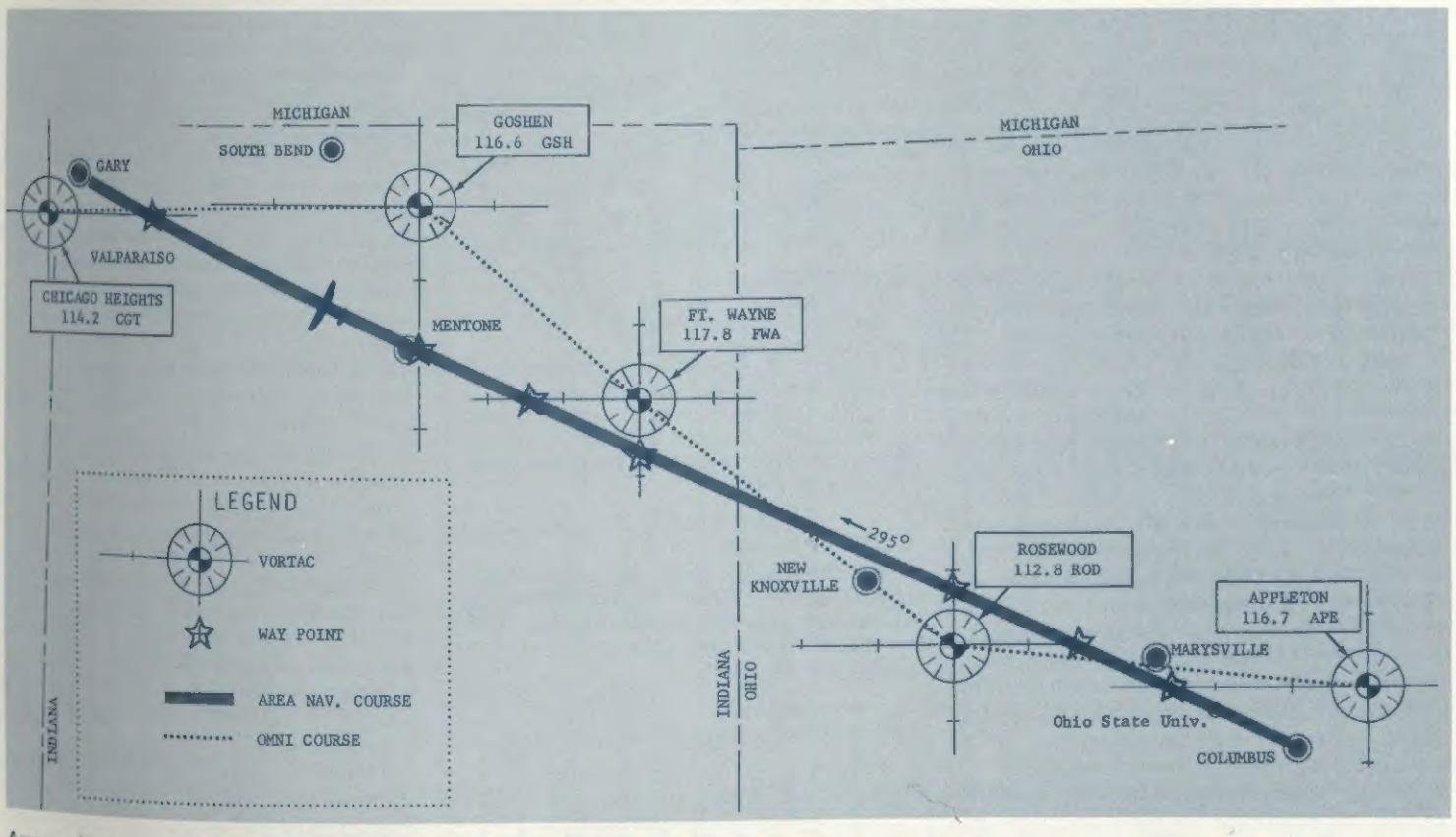
Only established area navigation routes and way points will be used in flight plans.

Protected airspace will extend to four nautical miles on each side of the route to a point 51 miles from the NAVAID, and then gradually increase to a maximum width of 10 miles on each side of the route at a distance of 130 miles from the NAVAID.

Applications for approval to install area navigation equipment in an aircraft should be made to the nearest FAA General Aviation or Air Carrier District Office.

FAA is issuing an advisory circular on this subject which amplifies the specifics referred to in this article.

Lewis Gelfan



Area navigation course plotted from Columbia, Ohio to Gary, Ind., using electronically computed way points, shows saving of 20 miles over OMNI course. Towns or land forms along the area navigation route serve as check points to confirm course visually.

Flying W. Ranch, 20 miles east of Camden, N. J. is typical of a modern utility airport located near a large metropolis.

airports with a future

A new handbook for communities planning to develop or improve a general aviation airport has been issued by the Federal Aviation Administration.

Entitled "Utility Airports," the new publication contains 14 chapters, each devoted to a different phase of planning and development. It is the first FAA publication to contain all the information a community needs to plan, design and construct a local airport.

The term "utility airport" is used to designate airports which will accommodate propeller-driven aircraft (including turboprops, but not pure jets) of 12,500 pounds gross weight or less. For planning purposes FAA lists three types of utility airports:

• *Basic Utility Stage I* is designed to handle about 75 percent of the aircraft in the utility category (weighing less than 12,500 pounds). This includes small single-engine aircraft such as the Cessna 150, the Piper Tripacer, and the Mooney Mark 20. The runway length is equivalent to 2,200 feet at standard operating conditions (59 degrees Fahrenheit at sea level).

This type of airport would serve adequately for communities with a small population or for remote recreation centers.

• *Basic Utility Stage II*, which calls for a runway with a minimum length equivalent to 2,700 feet at standard conditions, would accommodate about 95 percent of the so-called utility aircraft fleet. Typical of the aircraft suitable for such an airport are the Aero Commanders, the Beech Baron, the Cessna 310, and the Piper Apache. The heavier single engine aircraft and some of the light or medium twins would be in service—as well as any of the smaller single-engine aircraft mentioned under Stage I.

Medium-sized communities would be adequately served by these aircraft, which could provide some air taxi service as well as a variety of other useful business services.

• *General Utility* refers to an airport which would accommodate virtually all types of propeller-driven aircraft under 12,500 pounds. The minimum runway length, under standard conditions, would be 3,200 feet, and would conform to the needs of the heavier twins, such as the Beech 99, the Cessna 610, the de Haviland Dove, and the Piper Comanche.

A general utility airport would meet the needs of either communities located on the fringe of metropolitan areas or fairly large-sized towns remotely situated from any metropolis. All types of air taxis under 12,500 pounds could use the general utility airport.

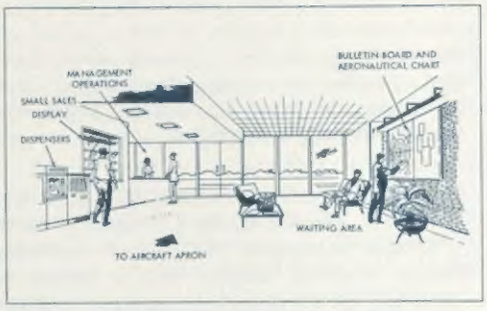
The handbook explains how an airport can benefit a community by attracting new industry, retaining existing industry, encouraging business growth, and providing access to the national airport system. The importance of an air taxi service, as well as a facility to serve smaller business and commercial aircraft are explained.

Other chapters offer information on wind analysis and runway orientation, runway length requirements and capacity, airspace protection and land considerations, preliminary site engineering, design criteria and dimensional standards, taxiways, turnarounds, holding aprons, aircraft parking and tiedown, buildings and hangars, lighting visual aids and markings, airport paving, operation, maintenance and administration, and construction plans.

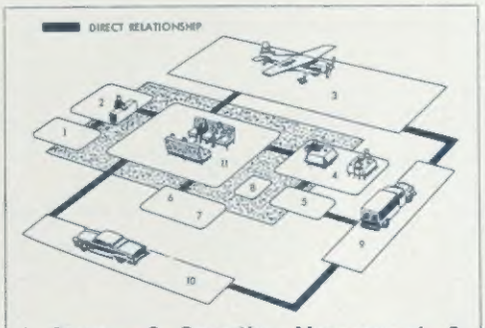
The publication also presents a variety of possible designs, a preliminary engineering checklist for field investigation, weather data source and analysis, a list of FAA Airports Service Offices and a bibliography on additional sources of information.

Particularly helpful to planners is a series of 11 fold-out drawings of construction plans for a typical small airport. Forty-two photographs and drawings of airport facilities are included to illustrate the discussion material.

"Utility Airports," AC No. 150/5300-4a, may be obtained by sending a check or money order for $1.75 to the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402. ■

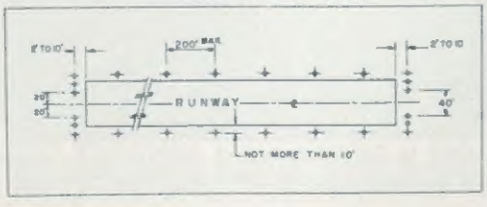


Airport planning manual makes extensive use of drawings like this one of a typical modern small airport waiting room.



1. Storage; 2. Operation Management; 3. Aircraft Loading Apron; 4. Dining Area; 5. Kitchen; 6. Rest Rooms; 7. Janitor Closet; 8. Utilities; 9. Service and Apron Access Drive; 10. Administration Building Drive; 11. Waiting Area.

Above—schematic view of administration building shows efficient layout. **Below**—typical medium intensity runway lighting system provides designers with data on FAA approved lighting configuration.



STATUS OF THE FEDERAL AVIATION REGULATIONS

As of July 1, 1969

The Federal Aviation Administration is re-issuing its Federal Aviation Regulations in a volume system. In about 12 months all FARs will be grouped into 11 volumes. As each volume is issued, an availability notice will be mailed to all persons now receiving the FARs. The availability of each new volume will also be reported in FAA Aviation News. In the meantime, the present publication system will remain in effect.

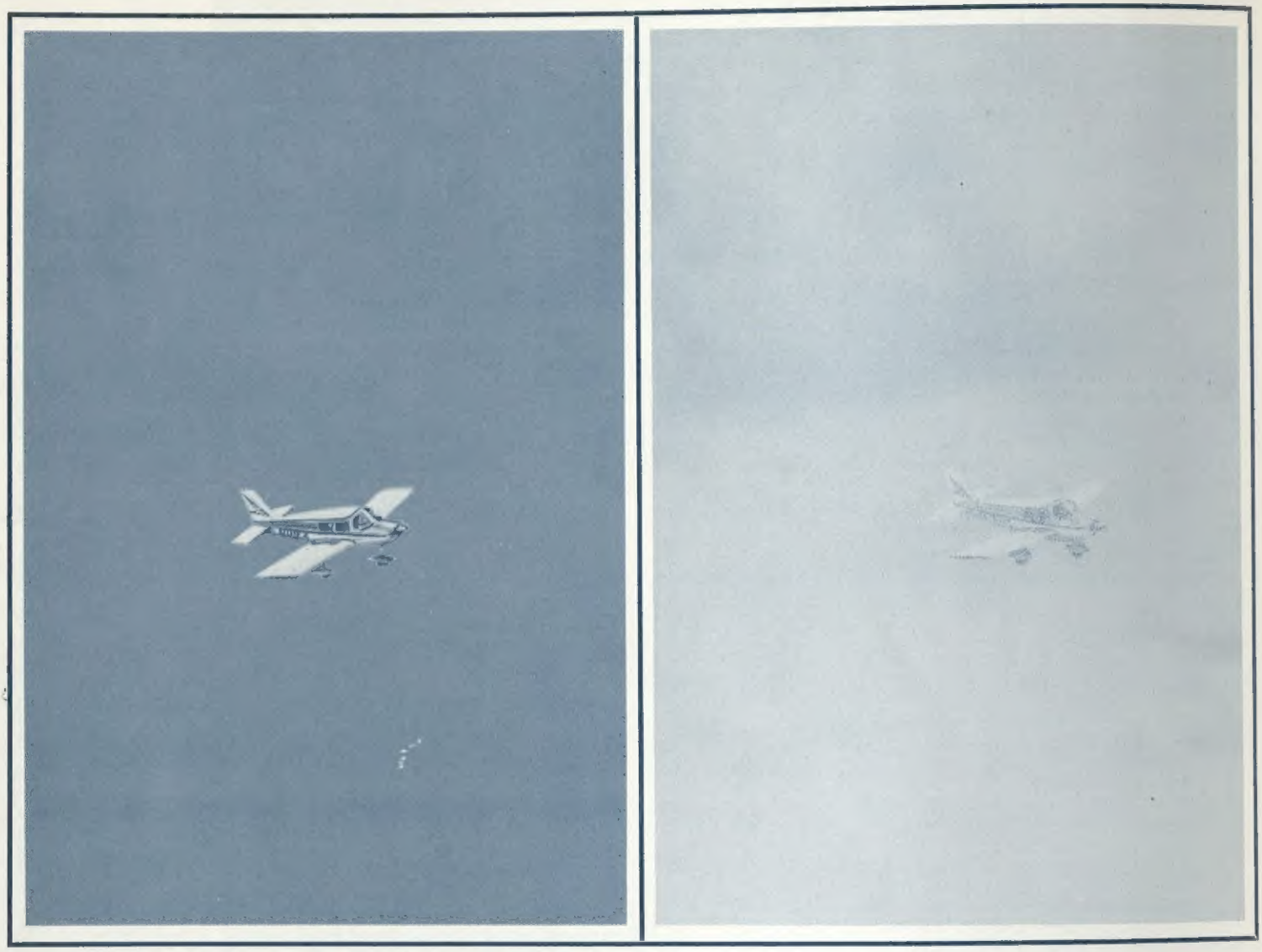
Distrbution of the volumes will be by the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 20402, who will set the price for each volume.

Volume I, which includes only FAR Part 1, became available in June.

FAR PART OR VOLUME NO.	TITLE	PRICE	CHANGES
Vol. I	(Part 1) Definitions and Abbreviations	$1.50 + 50c foreign mail	
11	General Rule-making Procedures	.35	9
13	Enforcement Procedures	.25	7
15	Nondiscrimination in Federally Assisted Programs of the Federal Aviation Administration	.20	....
21	Certification Procedures for Products and Parts	.60	21
23	Airworthiness Standards: Normal, Utility, and Acrobatic Category Airplanes	1.25	6
25	Airworthiness Standards: Transport Category Airplanes	2.25	19
27	Airworthiness Standards: Normal Category Rotorcraft	.70	3
29	Airworthiness Standards: Transport Category Rotorcraft	2.00	4
31	Airworthiness Standards: Manned Free Balloons	.20	2
33	Airworthiness Standards: Aircraft Engines	.40	3
35	Airworthiness Standards: Propellers	.30	2
37	Technical Standard Order Authorizations	1.00	5
**39	Airworthiness Directives	.20	1
43	Maintenance, Preventive Maintenance, Rebuilding, and Alteration	.55	9
45	Identification and Registration Marking	.30	6
47	Aircraft Registration	.25	6
49	Recording of Aircraft Titles and Security Documents	.20	4
61	Certification: Pilots and Flight Instructors	1.25	29
63	Certification: Flight Crewmembers Other Than Pilots	.35	10
65	Certification: Airmen Other Than Flight Crewmembers	.35	12
67	Medical Standards and Certification	.25	7
*71	Designation of Federal Airways, Controlled Airspace, and Reporting Points	.20	5
*73	Special Use Airspace	.20	1
*75	Establishment of Jet Routes	.20	2
77	Objects Affecting Navigable Airspace	.35	7
91	General Operating and Flight Rules	1.25	39
93	Specific Air Traffic Rules and Airport Traffic Patterns	.35	17
**95	IFR Altitudes	.25	....
**97	Standard Instrument Approach Procedures	.20	1
99	Security Control of Air Traffic	.25	7
101	Moored Balloons, Kites, Unmanned Rockets and Unmanned Free Balloons	.20	2
103	Transportation of Dangerous Articles and Magnetized Materials	.20	5
105	Parachute Jumping	.20	4
121	Certification and Operations: Air Carriers and Commercial Operators of Large Aircraft	2.00	32
123	Certification and Operations: Air Travel Clubs Using Large Airplanes	.25	1
127	Certification and Operations of Scheduled Air Carriers with Helicopters	.35	10
129	Operations of Foreign Air Carriers	.20	4
133	Rotorcraft External-Load Operations	.20	3
135	Air Taxi Operators and Commercial Operators of Small Aircraft	.35	5
137	Agricultural Aircraft Operations	.25	3
141	Pilot Schools	.35	7
143	Ground Instructors	.25	3
145	Repair Stations	.40	8
147	Mechanic Schools	.20	1
149	Parachute Lofts	.25	1
151	Federal Aid to Airports	.40	28
153	Acquisition of U. S. Land for Public Airports	.20	4
155	Release of Airport Property from Surplus Property Disposal Restrictions	.20	....
157	Notice of Construction, Alteration, Activation, and Deactivation of Airports	.20	1
159	National Capital Airports	.30	11
161	(Deleted effective 6/1/66)		
163	(Deleted effective 7/1/65)		
165	Wake Island Code	.30	2
167	Annette Island, Alaska, Airport	.15	—
171	Non-Federal Navigation Facilities	.25	4
181	(Rescinded 4/1/67)		
183	Representatives of the Administrator	.20	Re-issued March 1968
185	Testimony by Employees and Production of Records in Legal Proceedings	.20	"
187	Fees	.20	"
189	Use of Federal Aviation Administration Communications System	.15	"

* Changes to individual airspace designations and airways descriptions, individual restricted areas, and individual jet route descriptions are not included in the basic Parts 71, 73 and 75 respectively because of their length and complexity. Such changes are published in the Federal Register and are included on appropriate aeronautical charts.

**Due to the complexity, length, and frequency of issuance, airworthiness directives, enroute IFR altitudes and instrument approach procedures are published in the Federal Register and therefore are not included in the basic Parts 39, 95 and 97. In addition, enroute IFR altitudes and instrument approach procedures are published in the Airman's Information Manual, and are depicted on aeronautical charts.



An aircraft seen against a hazy background loses its sharp outlines and may appear deceptively distant to the viewer.

ALTITUDE MYOPIA

Pilots who have no trace of nearsightedness (myopia) at ground level may have experienced this condition at altitude without realizing what was happening. On a clear but hazy day, when mountains or other distant points are not outlined sharply against the horizon, the ability of the normal eye to maintain a distant focus is weakened. The focus tends to recede back toward the viewer after a short lapse of time, as the eye fails to find a distant point to fix on.

Under such circumstances, scanning for other aircraft becomes difficult and requires a special effort on the part of pilots. Otherwise, small targets may escape attention, and with the extremely rapid closing speed of high performance aircraft on converging or collision courses, the danger of an accident or near midair collision increases.

A recent Air Force study of a fatal accident, in which a light plane collided with one of four tactical jet fighters flying in close formation, draws attention to the limits of human vision and some of its peculiarities under conditions of low visual contrast.

In the incident cited, the four Air Force jets were climbing through 8,000 feet in an airspace designated as a high volume jet operation area (civilian aircraft are encouraged in the AIM to remain at or below 5,000 feet in this area). Nevertheless, a light plane was transiting the area on a course approximately parallel to the fighter jets, which were in a shallow climb at 420 knots. Weather was VFR, and the aircraft were not under Air Traffic Control.

The pilot of the number 2 fighter was requested to check a malfunction on the right external fuel tank of the lead plane. He visually cleared the area prior to moving closer to his leader and was viewing the tank when he heard the warning, "Light plane—12 o'clock." The pilot looked up in time to see a "light colored blur" which passed between him and the Number 1 aircraft. His vertical stabilizer sheared off several feet of the right wing of the civilian plane, which went out of control, disintegrated and crashed. There was no serious damage to the military aircraft.

The puzzling and disturbing question was how could four highly trained and proficient fighter pilots have failed to see the civilian aircraft in time to prevent the collision? The impact occurred about 15 seconds after the Number 2 pilot's last scan, but the

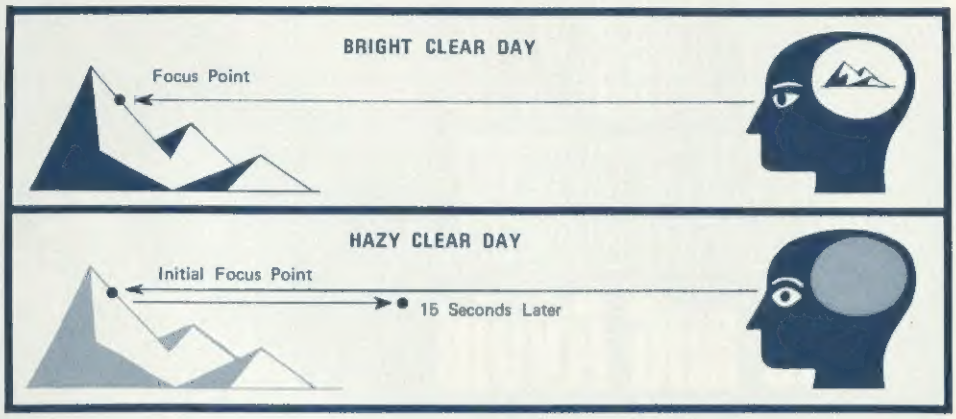
other three military pilots were scanning continuously. Visibility was good—estimated at 5 to 10 miles by the pilots.

The treacherous factor here was apparently haze, which created an indistinct background. Hazy sunlight desaturates color and contrast and makes it difficult to see clear outlines—especially if they happen to be painted white and turquoise as the light plane was.

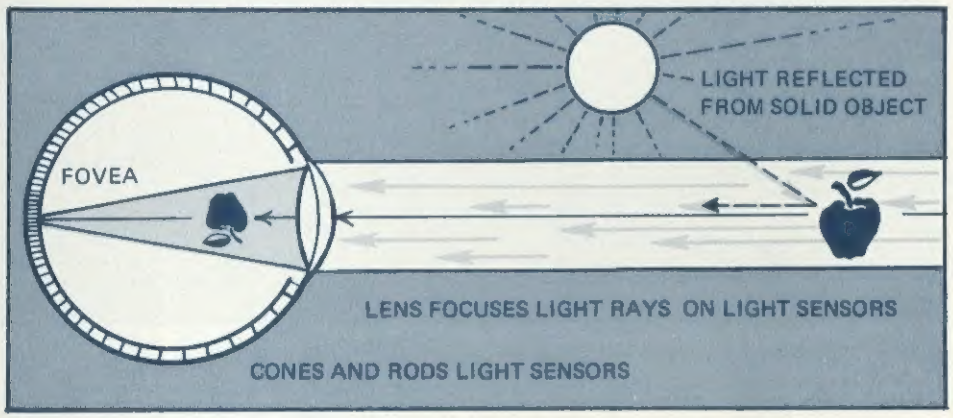
Under these conditions, the human eye has difficulty holding a focus at a distance greater than approximately one mile. The hazier the background, the greater the tendency of the focus to recede toward the viewer. Increasing altitude also plays a contributing role in this phenomenon.

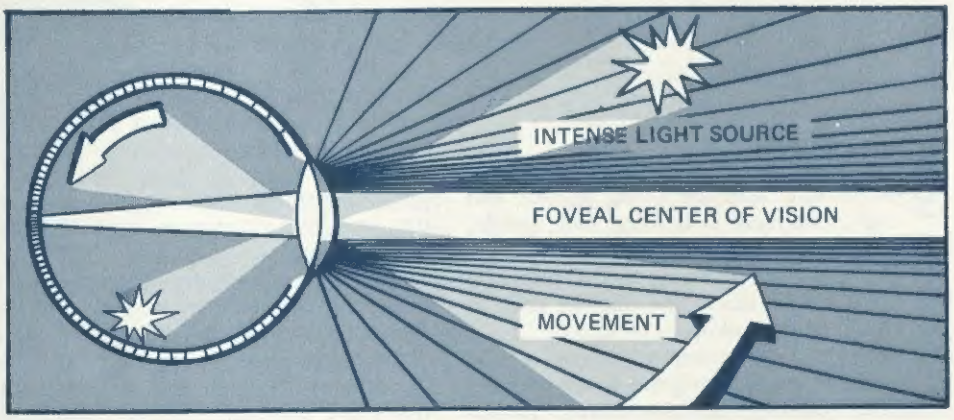
Since the military element and the light plane were on a parallel conflicting course, with a closure rate of about 5½ miles per minute, Air Force optical experts estimated that the pilots had only from about 5 to 10 seconds in which to take evasive action. Considering the time required for a pilot to perceive, react and effectively change the flight path, this was obviously not time enough.

An understanding of altitude myopia, or nearsightedness, should lead pilots to avoid circumstances in which the apparently good visibility does not actually permit aircraft identification at long range. Enhancing visibility by means of strobe lights, special paint, or other anti-collision devices can contribute to air safety. But perhaps the greatest safety lies in knowing the limitations of the human eye under varying weather conditions and realizing that "visibility ten miles" does not necessarily mean a pilot can see or be seen by others at that distance. ■

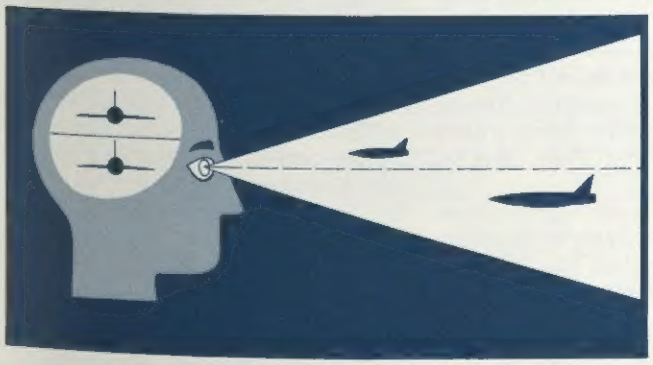


Greater effort is required to visually clear the flight path on a hazy day. When one focuses on a distant point, the focal point tends to recede back toward the eye with the passage of time as the eyes tire and relax, causing one to become "nearsighted".

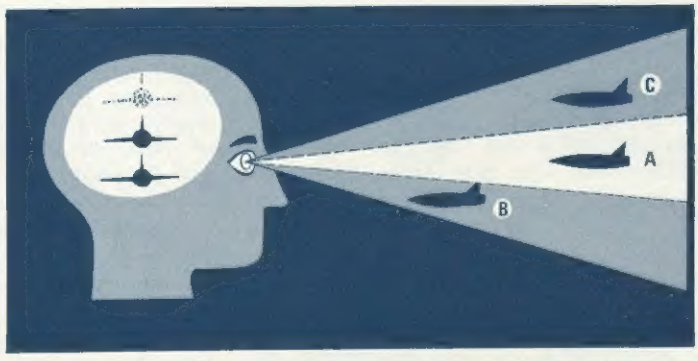




Cones, concentrated at the fovea, permit good visual acuity of objects in focus. Peripheral vision depends on intense light or movement to stimulate cells elsewhere in the retina. Focal depth as well as distinctness of outline are affected as the object moves into the peripheral range of the eye.



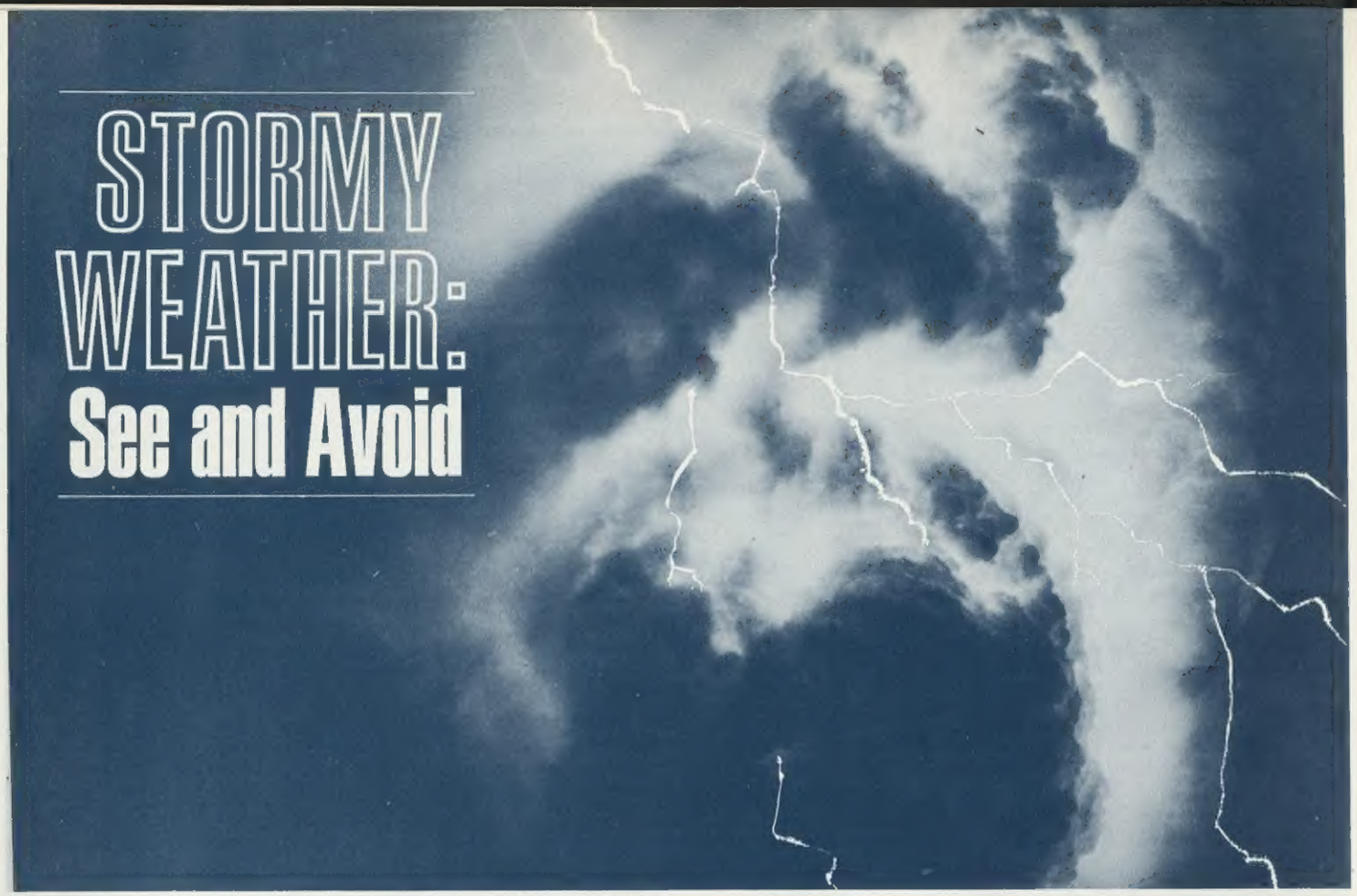
Visual acuity depends upon the angle from which we look at an object. **Above**—altitude myopia makes smaller but closer object appear about the same size as larger one further away.



Aircraft "B" (out of focus), registers as distant as "A", although it is much closer. Aircraft "C" (in periphery) seems smaller and less distinct even though it is as close as "A".

Artwork courtesy of *Aerospace Safety*, February 1969, an official U.S. Air Force publication.

STORMY WEATHER: See and Avoid



Turbulent winds produced by thunderheads can exist 10-15 miles ahead of storm.

Summertime, and the living is nice and easy, but there is nothing nice, gentle, or reassuring about thunderstorms or the blinding shafts of lightning that accompany them as they roll across the summer skies in search of unwary pilots.

The fury of the storm can knock a light plane out of the sky, and the accompanying deluge of water can obscure vision. The latter is particularly dangerous on landing or when flying low or over mountainous terrain. The heavy discharge of electricity released by lightning can affect electronic instruments and interfere with radio reception and transmission.

The danger is not restricted to flight. Thunderstorms can play havoc with improperly moored or sited aircraft.

The thunderstorm season in the latitudes that bracket the U.S. arrives in late spring, when temperatures rise, and continues until early fall. Rare indeed is an out-of-season thunderstorm because thunderstorms are the product of three interactions—*unstable air, high moisture content, and lifting action.* While the first two conditions can occur at any time of the year, lifting action commonly depends on warm surface air to raise the atmospheric mixture to a level where the moisture condenses to form cumulonimbus clouds.

All three ingredients come together most frequently in the immediate vicinity of Tampa, which has an average of 94 thunderstorms a year. Santa Fe, with a yearly average of 73 is second. The West Coast states are relatively free of thunderstorms, with only about one to four recorded each year.

Thunderstorm activity in the U.S. is greatest in the southeastern tier of states, a vast area that includes Louisiana, Mississippi, Georgia, Florida and the western part of North Carolina, and in New Mexico and Colorado.

Weather Bureau records are kept in terms of "storm-days," since hundreds of thunderstorms occur on any one day. The Weather Bureau estimates that 44,000 thunderstorms lash the earth each day. In this country the southeastern states average 45 storm-days from June 1 through August; the western states, about 35 storm-days. The rest of the U.S. experiences about 20 or less storm-days during the summer months.

Most thunderstorms occur during daylight, with the majority taking place late in the afternoon or early evening. However, they *can* happen in the morning, and night thunderstorms are common in the Southwest, the lower Michigan Peninsula, and an extensive area centered on eastern Nebraska.

Re-reading the Weather

Summertime flying calls for careful and detailed weather briefing, plus a rereading of basic publications on weather. The sentence or paragraph misunderstood or raced through the first time might make a life-saving impression the second time around.

Weather reports of cold fronts or line squalls across the proposed line of flight should be carefully checked out. These are the conditions that contribute to setting up the three components of a thunderstorm—unstable air, high moisture content and lifting action. Thunderstorms are sometimes "imbedded" within marginal weather which in itself would not be dangerous. A sudden, unexpected collision with such a storm could have fatal results or result in severe damage to the aircraft.

When thunderstorms are forecast, prudent pilots will stay on the ground if visibility is

less than three miles and ceiling less than 1,000 feet.

Thunderstorm clouds—cumulo-nimbus—present an awesome, majestic appearance, and some pilots have been lured into danger by an urge to see the cloud up close. Thunderstorms should be avoided by at least five miles and new data gives evidence that dangerous winds exist as much as 10 to 15 miles in advance of the storm. The speed of the storm itself across the terrain can be as high as 60 mph, and as low as zero mph.

No attempt should be made to fly *under* a thunderstorm—downdrafts and turbulent air could wrest the plane out of the pilot's control. Under the proper conditions, a thunder cloud could also bombard a plane passing underneath with hail interspersed with rain. Also, hail can be encountered in clear air several miles from the thunderstorm itself.

During thunderstorm conditions, pilots should be prepared to retrace their flight path or terminate the flight rather than run the risk of being surrounded by a storm, with no avenue of escape. Penetration with the thought of passing through a thunderstorm is extremely hazardous. The storm system may extend for hundreds of miles, and many have tops that exceed 35,000 feet.

Lightning and thunderstorms go together—one doesn't exist without the other. While lightning strikes on aircraft are extremely rare, they do occur. Damage is generally negligible, but a bolt striking an antenna can deliver a jolt sufficient to destroy avionic components. Aircraft skin damage and cracked windshields have been caused by lightning. Aircraft crews have reported mild shocks and a lingering numbness following a strike. There is some suspicion that in rare instances a lightning strike could cause ignition of vapors in the aircraft fuel system.

Hits and near misses of lightning can cause a permanent error in the reading of the magnetic compass and in electrical instruments. When flying in a thunderstorm area the cabin lights and instrument panel lights should be turned on full bright to reduce the possibility of temporary blindness caused by a close bolt of lightening. Dark glasses should also be used to avoid temporary blindness from nearby flashes of lightning.

Lightning Potential

Lightning should be anticipated when flying through clouds during the thunderstorm seasons. Even though no rain is falling, lightning potential is there since lightning is the transfer of electrical energy from one charged area to another—from cloud to cloud.

The aerodynamic reasons that enable an aircraft to fly—the large lift surfaces in relation to weight—make it especially vulnerable to thunderstorm damage even on the ground. The accompanying high winds toss exposed or unmoored planes about like sheets of paper. If possible, aircraft should be hangared or flown to a safe area when large or severe wind storms are forecast.

Wind-propelled debris can cause aircraft damage. Parking an aircraft close to trees is unwise since a lightning shattered tree could topple on the plane. Lightning striking an aircraft on the ground is almost unheard of but even so, refueling should not be attempted during a thunderstorm.

Aircraft should not be left unmoored or unchocked for any length of time, particularly during the thunderstorm season. When high winds are forecast, the plane should be headed *into* the expected direction of the wind, brakes set, wheels chocked and the nose or tail wheel locked.

Aircraft should not be moored any closer to each other than a distance equal to the major axis (wingspan or fuselage length) plus 10 feet. Each tie-down post should have a holding power of approximately 3,000 pounds and marked with white or yellow paint for easy recognition. The strength of the tie-down rope should match the anchor point.

Ropes should be secured to tie-down points on the plane with about an inch of slack, and anti-slip knots such as a bowline or square knot used. Flight controls should be locked and spoilers may be placed on the wings to kill lifting action.

High velocity surface winds are particularly hazardous to helicopters. The rotors should be secured according to manufacturer's instructions. Seaplanes should be tied down (on land if at all possible) in the usual manner but in emergencies seaplane pilots have partially flooded the floats of their aircraft to gain added security in high winds.

Thunderstorms are hazardous, but their behavior is well known and their arrival is rarely so swift that they trap pilots who understand basic weather behavior, and who make it a firm practice to check the weather thoroughly.

Especially in summer. ■

Figure 1.

Figure 2.

Figure 3.

Top—proper tie-down (fig. 1) allows plane one inch movement. Red streamers mark external surface locks (fig. 2); ropes should be tied to rings on struts (fig. 3), (not to struts).

FLIGHT PROCEDURES NEAR SEVERE STORMS

Avoidance Distances for Aircraft Equipped With Narrow Beam Radar

Flight Altitude (1000s of Ft)	Echo Characteristics			
	Shape	Intensity	Gradient of Intensity*	Rate of Change
0-20	Avoid by 10 miles echoes with hooks, fingers, scalloped edges, or other protrusions.	Avoid by 5 miles echoes with sharp edges or strong intensities.	Avoid by 5 miles echoes with strong gradients of intensity.	Avoid by 10 miles echoes showing rapid changes of shape, height, or intensity.
20-25	← Avoid all echoes by 10 miles →			
25-30	← Avoid all echoes by 15 miles →			
Above 30	← Avoid all echoes by 20 miles →			

* Applicable to sets with ISO-echo. ISO-echo produces a hole in a strong echo when the returned signal is above a pre-set value.

1. If the flight is over storm clouds, always maintain at least 5000 ft vertical separation from cloud tops.
2. If aircraft is not equipped with radar, or radar is inoperative, avoid by 10 miles any storm that by visual inspection is tall, growing rapidly, or has an anvil top.

Hook

Finger

U-shaped

Scalloped-edge

FLIGHTS

Nancy Four was Number One

Which was the first aircraft to cross the Atlantic . . . Lindbergh's *Spirit of St. Louis?* No. Alcock and Brown's Vimy bomber? No, try again.

Her name was Nancy Four (officially the NC-4) and she was a vessel of the United States Navy, a huge Curtiss flying boat that hopped and skipped her way across the ocean over 50 years ago. Her reward was a moment of glory and a half century of near oblivion. History seemed to conspire against this step-child of aviation and she might have crumbled quietly into dust except for the devotion of one man, Paul Garber.

Nancy Four conquered the Atlantic in a heroic 19-day argosy that began at Rockaway Beach, L.I., on May 8 and ended in Lisbon on May 27 (see FAA AVIATION NEWS, March, 1968). Her arrival, unfortunately, was ill-timed—the huge flying boat, with a wingspread nearly as great as that of a modern jet, skimmed into the harbor at twilight when half of the crowd that had waited all day had left. The fading light made photography impossible and the "arrival" had to be re-staged the following day for newsreel cameramen.

Nancy Four returned to the U.S. as deck cargo in the summer of 1919. On Sept. 22 she set off on a recruiting sweep that covered the Atlantic coast from Rockaway, L.I., south to Florida, along the Gulf coast, up the Mississippi to Cairo, Ill., and back. She also made side trips to New Orleans and Galveston. In all, she visited 35 cities, attracting huge crowds wherever she went.

Then she was taken off flying status and dismantled. In 1923 she was re-assembled and displayed at the base of the Washington Monument during a Shriners Convention. In 1926 she was assembled in the Government Building during the Philadelphia Sesquicentennial. Despite careful handling, the NC-4 was beginning to acquire nicks and cracks, torn fabric and general deterioration as the awkward craft was moved in and out of storage.

Paul E. Garber, who until his recent retirement was Assistant Director for Aeronautics, National Air and Space Museum, Smithsonian Institution, had followed the career of Nancy Four ever since he first saw her in 1917 at the Rockaway Naval Air Station. He wanted to acquire the plane for the museum before it succumbed to the wear and tear of "show business" and indifferent handling.

The Navy was willing to turn the aircraft over to the museum but a suitable display proved difficult to find. For a time in the '20s the hull, much the worse for wear, was on view in the Smithsonian's Aircraft Building. Later, Garber's dogged concern for the NC-4 probably saved the historic aircraft from a fiery death; two weeks after he had removed the hull from a storage shed in Philadelphia, the building burned down.

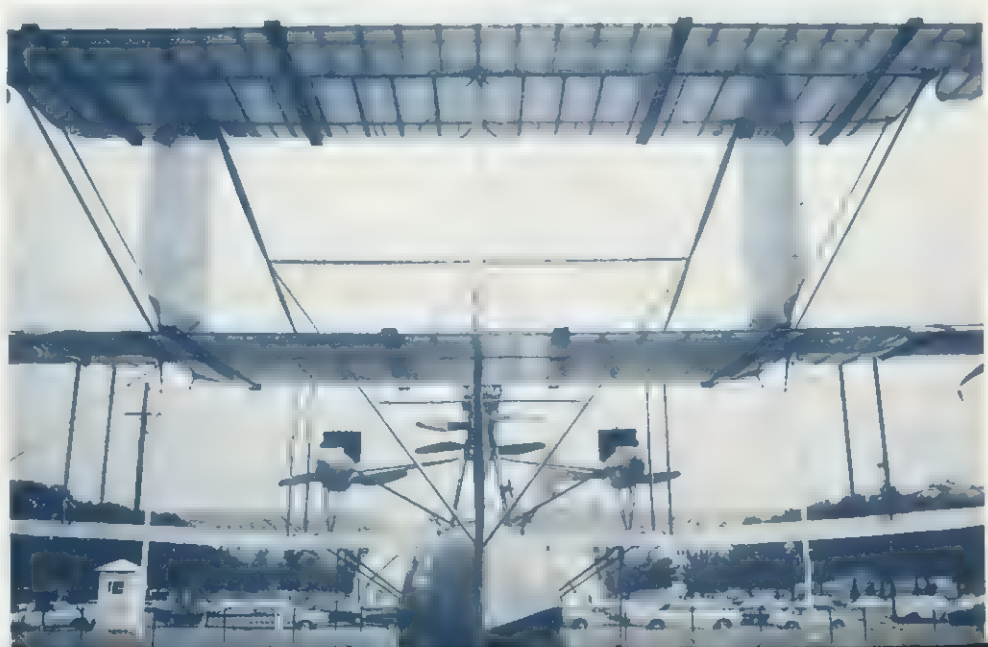
The wings, tail surfaces, engines, propellers and assorted boxes of fittings and cables were shuttled from one naval site to another, including the Naval Air Station at Anacostia on the southern rim of Washington, and the Naval Torpedo Factory at Alexandria, Va. Somewhere along the line, the propellers disappeared. Wherever the components were lodged, they were regarded as a nuisance.

World War II intervened and Garber was commissioned in the Navy, but the NC-4 was never far from his mind. On a trip to the Naval Torpedo Factory, in the course of his duties, he was stunned to discover that no one knew the whereabouts of the NC-4 parts. They had disappeared. Through diligent questioning, prompted by a growing sense of panic, Garber tracked them to the huge Navy complex at Norfolk, Va. He hastened there only to be informed by a Chief Petty Officer that instructions had been given to clear out the warehouse.

Fearful of the plane's delicate structure, by now almost 25 years old, Garber made an appointment to see the base's commanding officer. By luck, he turned out to be Adm. Patrick N. L. Bellinger who as a Lieutenant Commander had skippered the NC-1, a sister to the NC-4.

Garber obtained possession of the NC-4's disassembled parts and moved them to a temporary storage near Cheatham, Va. and at war's end, to the Air and Space Museum's preservation and restoration branch at Silver Hill, Md. a Washington suburb.

In 1964 the restoration branch began the arduous task of restoring the aircraft to



Above—the NC-4 taxies into the harbor at Lisbon following her historic flight, the first across the Atlantic. **Below**—50 years later, the restored flying boat is displayed to visitors on the Mall in Washington, D.C.

Restoration specialists adjust wing fittings on NC-4. The biplane wing and tail construction of the aircraft required hundreds of feet of cable support.

new condition. Two years ago the job was pushed into high gear in order to have the plane ready for display in Washington for the 50th anniversary commemoration.

The original blueprints came out of storage, as did some vanishing aircraft maintenance skills like aircraft woodworking, fabric covering techniques for huge surfaces, and wire rigging.

When the restorers had finished, NC-4 looked exactly as she did when she took off for her flight into history 50 years before.

On May 8, 1969, 50 years after her historic Atlantic crossing, Nancy Four was once again in the limelight as the Navy and the Smithsonian Institution joined forces to give her a belated recognition. Splendidly restored and prominently displayed outdoors on the green mall in Washington, D.C., the huge flying boat was exhibited to the world via television.

Far from being a stunt, the flight of the NC-4 had legitimate aeronautical value—her design concepts were incorporated by a number of designers into an international family of flying boats, culminating in the various *Clippers* and the long range patrol bombers of World War II.

The flight was hailed by an obscure young Naval aviator writing in the *Yale Graphic*, who predicted that it would "demonstrate that a flight across the Atlantic is a perfectly safe and sane commercial proposition and not a gigantic gamble."

The writer was Juan Terry Trippe, who would become founder, president and then chairman of the board of Pan American World Airways. His *Clippers* later flew the same transatlantic route and spanned the Pacific.

Once more the NC-4 has gone into storage at Silver Hill, now to await the erection of the New Air and Space Museum where it will be on permanent display. There the conqueror of the Atlantic will "fly" forever, in company with other historic aircraft that pioneered the skies

Frank J. Clifford

BRIEFS

• DUSTERS WHO USE PARAQUAT are warned by the Federal Air Surgeon that a number of accidental deaths have been reported resulting from several exposures to minute quantities of this herbicide. He reminds dusters that paraquat has a specific, delayed and irreversible effect upon the lungs and that there is no known antidote. He recommends that the compound not be used by anyone other than licensed applicators who are thoroughly indoctrinated on proper precautionary measures.

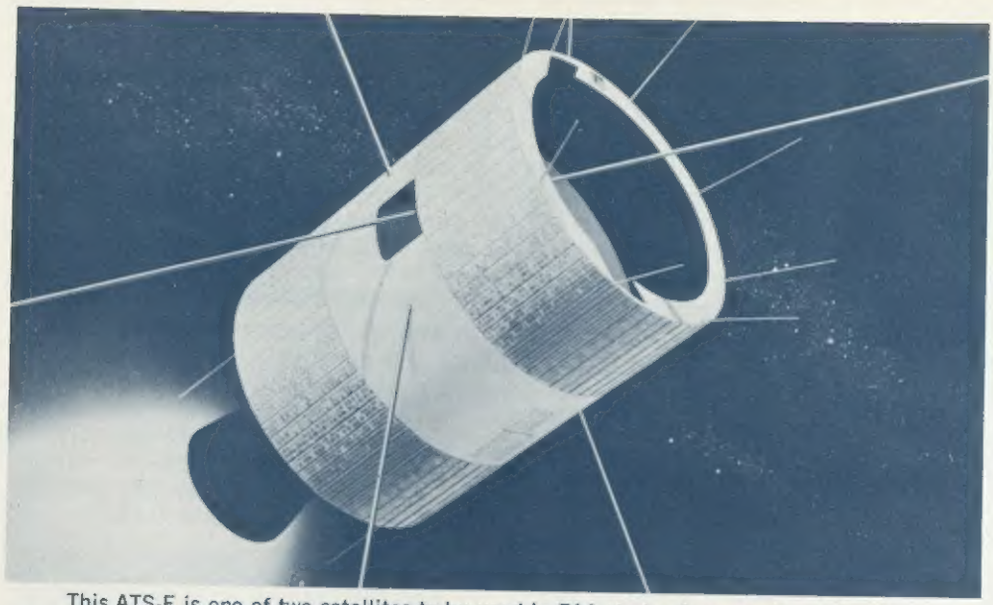
• PILOTS FLYING TO FLORIDA TO SEE APOLLO II LAUNCH July 16 are cautioned to note special regulations for the event. Restricted areas 2902 A and B prohibit aircraft from flying over the launch area and special FAA Regulation 15 requires approved flight plans for any overwater flight south of 29° N latitude (New Smyrna Beach). Consult the AIM and appropriate charts to become familiar with the area. Titusville (TI-CO) Airport will have a temporary FAA tower and direct tie-line to the Melbourne Flight Service Station to handle the huge influx of traffic. All pilots are cautioned not to interfere with offical traffic in the area by flying near the Cape during hours around lift-off. Go early; make advance reservations for yourself and your airplane, and expect departure delays.

• RESERVATION SLOTS FOR HIGH DENSITY AIRPORTS. (JFK, LaGuardia, Newark, O'Hare and Washington National) are coordinated through a central Airport Reservation Office at FAA headquarters in Washington, D.C. The nearest FSS will handle all requests. Advance reservations up to 48 hours ahead will be accepted for IFR traffic only; inbound VFR traffic should contact the FSS nearest the high density airport when 30 miles out, and be prepared to land at an alternate airport.

• A PERMANENT STOL RUNWAY, to be used to test short takeoff and landing aircraft and associated equipment, will be in operation late this summer at FAA's National Aviation Facilities Experimental Center (NAFEC), Atlantic City, N.J. It will be established on part of a runway previously but not now used for conventional aircraft and will be equipped with approach slope indicators, edge lighting, threshold lights, runway remaining lights, stop-bar lights and centerline reflectors. Other FAA-operated STOL runways are at Washington National and Dulles International.

• CHIEF PILOTS COULD BE DESIGNATED with less than three years of experience as pilot-in-command, under an amendment (Notice 69-18) to FAR 121.61 proposed by FAA. The agency is now studying comments on the amendment which would permit the Administrator to make exceptions to the three year rule when the candidate has had equivalent aeronautical experience.

• NEW ENTRY in the jet liner category is this Fokker F-28, recently awarded a type certificate by FAA. Powered by two turbo-fan engines, the F-28 cruises at 35,000 feet at more than 500 mph. It was designed for short-field operation and is described as being suitable for executive transport, as a flying sales office, and regional air liner.



This ATS-E is one of two satellites to be used in FAA study of over-water navigation.

FAA ORDERS STUDY OF SATELLITES AS NAVIGATION AIDS

The usefulness of satellites, fixed in synchronous orbit 22,000 miles above the earth, as a means to provide improved air traffic control communications and position surveillance to aircraft flying ocean routes will be explored under an FAA contract awarded to the Boeing Co., Renton, Wash.

FAA seeks to measure the accuracy, reliability and power of radio signals in the so-called "L-band," from 1540 to 1660 MHz, to accurately locate aircraft position, and study voice and digital data transmission on over-water signal paths. The main purpose of the study is to accumulate information on signal propagation and establish criteria for operational satellite systems.

The vehicle to be used is an Applications Technology Satellite (ATS-E), scheduled for launch by NASA this September. Testing will commence in March, 1970, according to present plans. Another satellite, an ATS-F, will be launched in 1971 to join the first, to allow dual satellite investigation.

Tone-ranging is one of the signaling techniques to be tried. A tone-modulated ground signal will be sent to the satellite, where it will be translated into the L-band and directed to the aircraft. The aircraft transmitter returns the signal to earth via the satellite, and the phase difference between outgoing and incoming signals, together with the known satellite locations, is used to compute aircraft position.

Digital ranging techniques will also be tested, in cooperation with the NASA Electronics Research Center.

An FAA KC-134 will participate in the tests to gather over-water signal path data.

New Airport Fund is $34,144,479; 45 General Aviation Airports Aided

Forty-five general aviation airports are included in the 177 public civil airports slated to receive a total of $34,144,479 in Federal matching funds under the Fiscal Year 1970 Federal-aid Airport Program.

Of the 177 airports in the program, 132 serve all segments of aviation and all have scheduled airline service.

The matching funds are to be used in the construction and improvement of runways, taxiways, airport lighting and other facilities but does not include work on terminal buildings.

The allocations are based on $30 million appropriated by Congress and carryover funds from previous years. Of the 177 airports in the program, 132 are presently serving all segments of aviation, including scheduled air service. The remaining 45 airports are for exclusive general aviation use.

The 1970 program stresses preserving and expanding facilities at existing airports to accommodate the high-performance aircraft now used by all segments of the aviation industry.

John H. Shaffer, Federal Aviation Administrator, said that "in formulating the program, FAA carefully evaluated 777 requests from state and local officials seeking airport improvements that would have required a Federal outlay of nearly half a billion dollars. Our limited available resources were channeled to the most urgent demands and, regrettably, many worthwhile and necessary projects fell by the wayside."

The 1970 appropriation represents the last year of funding authorized under the present Federal Airport Act, but continuation of aid for public airports is being sought in the airport/airways improvement and expansion legislation being submitted to Congress by the Department of Transportation.

Two-Volume National Aviation Plan Now Available to General Public

The 1970-79 FAA/DOT National Aviation System Plan, presented to participants of the First Annual Planning Review Conference held in Washington, D.C. April 23-25, 1969, has been published in two volumes.

Book I deals with the FAA system requirements and criteria in five aviation areas: air traffic control, navigation aids, communications, weather and airports. Book II contains the FAA's proposed investment plans for the 10-year period, 1970-79, to meet its systems requirements.

To order, send your check for $3.00 per volume directly to the Clearinghouse, 5285 Port Royal Road, Springfield, Va. 22154. Order by AD number (Book I—AD 686-047 and Book II—AD 686 048).

BAMBOO RUNWAY STOL aircraft used for transport of oil company personnel and machinery, lifts off in Colombian jungle. Bamboo provides a resilient airstrip for heavily laden planes operating from the soggy jungle floor. Surrounding forest provides unending supply of bamboo. Native labor can put down enough for a runway in a few hours.

FAA Aviation News welcomes comments from the aviation community. We will reserve this page for an exchange of views. No anonymous letters will be used, but names will be withheld on request.

• Special VFR

Suppose the airport weather observation is well above basic VFR weather minimums, but there are either scattered clouds below 1,000 feet, or there are scattered areas of fog or snow showers. The airport, and so the control zone, are VFR.

Can a pilot request an ATC clearance, and can a control tower issue an ATC Special VFR clearance, in order to cover an edge or extension of the control zone that is not in basic VFR minimums?

Muncie, Ind.

If weather conditions are such that a pilot cannot proceed and remain in basic VFR weather while transiting a control zone or while approaching an airport within a control zone, it is his responsibility to maintain VFR and request a Special VFR clearance.

A Special VFR clearance may be issued at a pilot's request even though the reported weather at the airport is at or above basic VFR minimums. However, this would not apply to certain control zones (specified in FAR 93) where Special VFR operations are not permitted.

The governing FARs are 91.105 and 91.107.

• Weatherwise

I was most interested in Mr. Cirillo's suggestion in "Weather Wise and Plane Safe" in the December 1968 FAA *Aviation News*. I have copied his weather map on the back of a flight plan form I devised so that I have a picture of the weather, along with the appropriate notations on one side and my flight plan on the other.

I have been testing it myself and with a few friends, and the results are most positive. Having tangled with bad weather once I don't want to have it happen again. I knew what the weather was but I didn't have a picture of it, so consequently I flew into a situation which required the friendly services of FSS. By using Mr. Cirillo's suggestion I can help myself before taking off.

Thank you for publishing Mr. Cirillo's idea. It has helped to make me a safer pilot.

John C. Rinehart
Parshall, N.D.

• Early American Aircraft

I would very much appreciate your assistance in running down as much information as possible on the 1947 Stinson *Station Wagon*, model 108-2.

I would like to acquire any feature articles and or specifications regarding this make and model.

Tom W. Hart
Santa Maria, Calif.

A likely source of information is the Antique Airplane Association, Rt. 5, Industrial Airport, Ottumwa, Iowa 52501. You also might try the Experimental Aircraft Association, P.O. Box 229, Hales Corners, Wis. 53130.

• Seal of Competence

Your article on "The Course that Refreshes" (April, 1969) says that student participation is encouraged. By "student" do you mean the instructor taking the course, or are all pilots encouraged to attend? Also, how can you tell whether your instructor has attended any of these courses?

Overlook Park, Kans.

Instructor courses are intended for instructors only, although eligibility in each case is determined by the sponsor of the refresher course. In most instances, FAA is not the sponsor, but simply a participant, supplying instructors and instructional materials.

Most (but not all) instructor refresher courses award a certificate on completion. FAA will also revalidate an instructor's certificate with a gold seal when he has completed such a course. You can ask to see this evidence, if you wish.

• Voice in the Wilderness

Several months ago I was helped out of a tough spot in Montana by being vectored out of a fierce wind to a safe landing by the gang at the Billings, Mont., FSS. They kept me talking—apparently this was a key ingredient in the method they used.

How does this work? Have you had an article on it?

Ira Harkey
University of Alaska

Radio transmission from a pilot is a vital component in doppler direction finding technique. The radio signal from the aircraft is picked up by a ground receiver and the direction finder scope displays an azimuth directly to the source of the transmission.

A full description of doppler direction finding is contained in "It's Hard to Stay Lost" in the July 1968 FAA Aviation News.

• Base Ratings

On a recent round trip from Norfolk to Colorado I stopped at three fixed base operators, all at large fields. The service I received from two of these was excellent, while at the other I almost had to beg even to be noticed.

While taxiing in at this third field, I wondered why I didn't see more light aircraft on the field. I found out later most light planes used another field about five minutes away. Small wonder.

I'd like to know if anyone has taken the time to document or grade the fixed base operators (like a Duncan Hines rating) so a pilot could stay away from FBO who does not want him?

F. S. Jr.
Smithfield, Va.

FAA maintains no such list. You might direct a letter to Frank Kingston Smith, President, National Aviation Trades Association, Dupont Circle Building, 1346 Connecticut Ave., N.W., Washington, D.C. 20036.

• Banners Flying

We are interested in obtaining the name of a manufacturer of illuminated banners suitable for towing behind an airplane. We operate a Cessna 172, if that is any help in satisfying our inquiry. We are already informed on daylight banners.

M. S. Sheikh
Multan Flying Club
W. Pakistan

FAA knows of no firms manufacturing illuminated banners for towing behind an airplane. While illuminated signs are carried aloft by blimps and helicopters, the method of "launching" and recovering banners towed by airplanes would make it difficult to design a lighted banner for use by an airplane.

To get the banner into the air, it is dragged along the ground for a short distance; prior to landing, the banner is cut loose and dropped to the earth. Both processes could shatter the lighting elements.

• Tin Lizzie Airline

The February 1969 *FAA Aviation News* had a "Brief" item on the new *Bushmaster*, a modernized version of the fabled Ford *Tri-Motor*. It is my understanding that one of the *Bushmasters* is flying with a small airline somewhere in Michigan. Is this so?

Alex Mays
Vancouver, B.C.

Apparently you have in mind Island Airways, which does not have a Bushmaster, but operates two Ford Tri-Motors (formerly also a Boeing 247) on a nine-mile route that serves Put-in-Bay, North Bass, Middle Bass, and South Bass Islands in Lake Erie, and Kelly Island in Canada.

Home base is Port Clinton, Ohio, Post Office Box 172.

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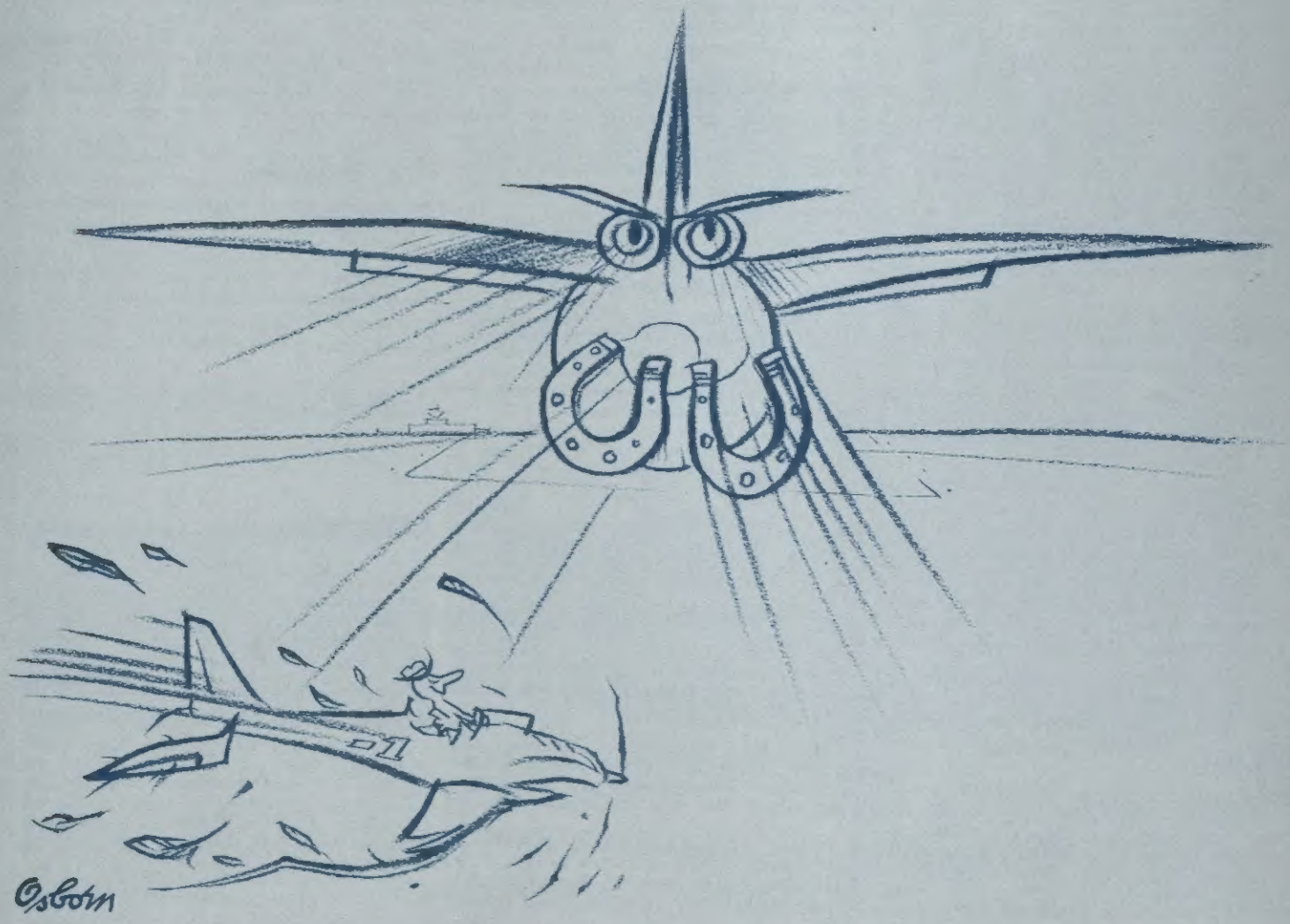

There may be a jet with a kick like a horse

Suggested by K. R. Grant